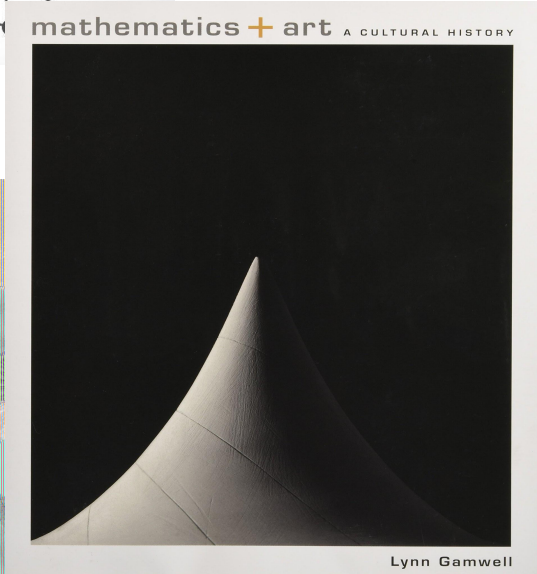
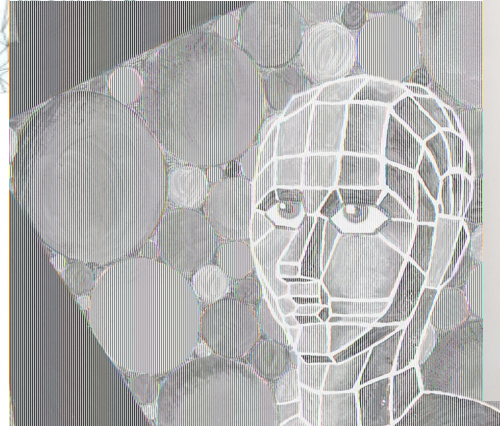
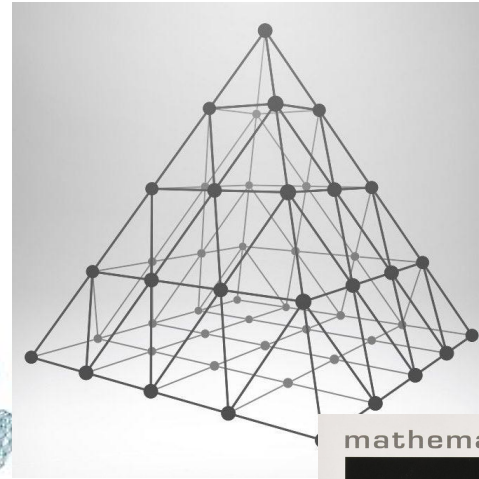

Mathematics and the Arts, Music, Perspective and Symmetry & The Golden Ratio

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How is Mathematics and the arts related?

Mathematics and the Arts are related in many ways such as, that Mathematics has described itself as an art motivated by beauty. Many artists use math to create a certain perception for their audience. Also they use it to make their art work look more realistic. The closest connection between music and math is that they both use patterns. Music has repeating choruses and sections of songs and in math, patterns are used to explain and predict the unknown. We decided to choose this topic over the others because we all like to see and or use math in a fun way.

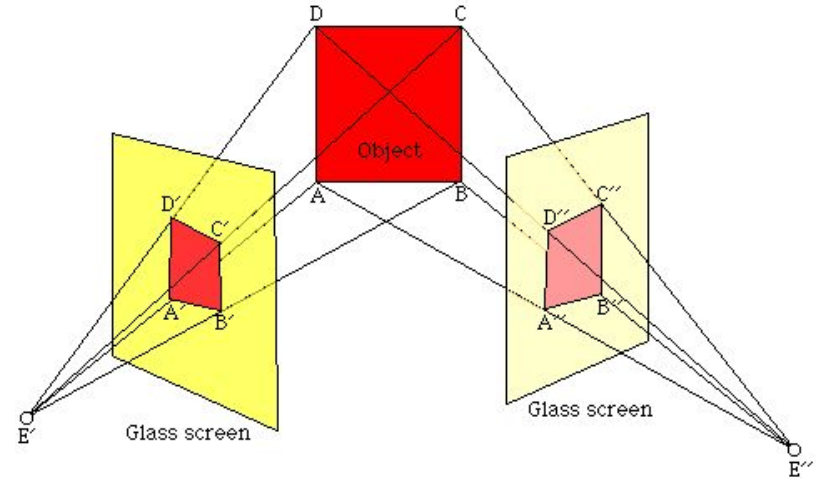
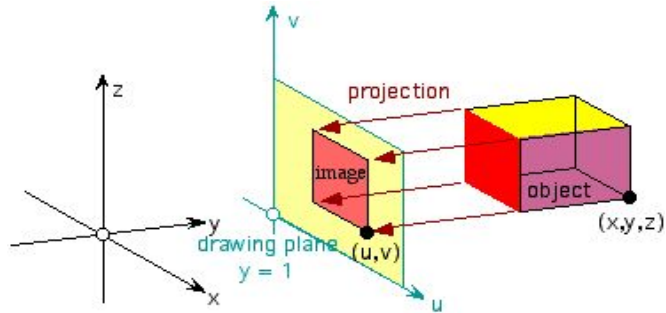


Perspective

Perspective a way of adding depth to 2 dimensional image.

Perspective is the art and mathematics of realistically depicting three-dimensional objects in a two-dimensional plane, sometimes called *centric or natural perspective* to distinguish it from biocentric perspective. The study of the projection of objects in a plane is called *projective geometry*. These rules are summarized by Dixon (1991):

1. The horizon appears as a line.
2. Straight lines in space appear as straight lines in the image.
3. Sets of *parallel* lines meet at a *vanishing point*.
4. Lines *parallel* to the picture plane appear *parallel* and therefore have no *vanishing point*.



Symmetry

In mathematics, symmetry is a property of an object that remains unchanged under certain operations.

Reflection symmetry: An object has reflection symmetry if it remains unchanged when reflected across a straight line. For example, the letter *A* has reflection symmetry about a vertical line, while the letter *H* has reflection symmetry about a vertical and a horizontal line.

Rotation symmetry: An object has rotational symmetry if it remains unchanged when rotated through some angle about a point. For example, the letters *O* and *S* have rotational symmetry because they are unchanged

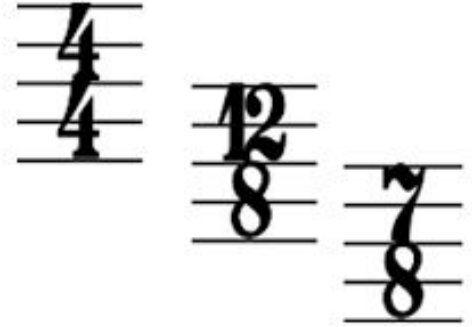
•
Translation symmetry: A pattern shows translation symmetry if it remains the same when shifted, say, to the right or left.



MATH AND MUSIC

Musical pieces are read much like you would read math symbols. The symbols represent some bit of information about the piece. Musical pieces are divided into sections called measures or bars. Each measure embodies an equal amount of time. Furthermore, each measure is divided into equal portions called beats. These are all mathematical divisions of time.

For example fractions are used in music to indicate lengths of notes. In a musical piece, the *time signature* tells the musician information about the rhythm of the piece. A time signature is generally written as two integers, one above the other. The number on the bottom tells the musician which note in the piece gets a single beat. The top number tells the musician how many of this note is in each measure.



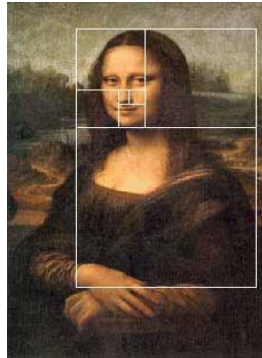
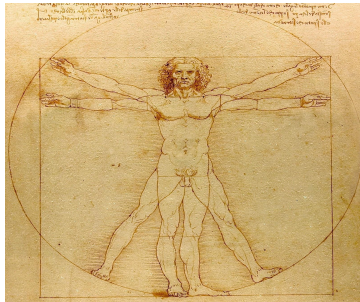
The Golden Ratio

The Golden Ratio also known as *Golden Mean*, *Golden Section*, and *Divine Proportion* is found by dividing a line into two parts so that the long part divided by the short part is equal to the whole length divided by the long part.

The Golden Ratio is a special number that approximately equals **1.618**. In fact it's known to be an **Irrational Number**.

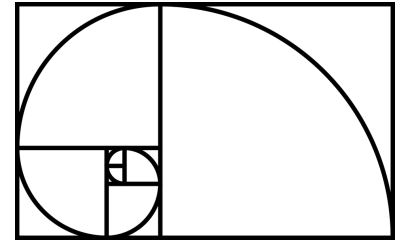
Formula: $\phi = \frac{1 + \sqrt{5}}{2}$

This mathematical concept is said to appear in nature and in various iconic pieces of art which has inspired artists such as *Michelangelo* and *Leonardo da Vinci*.



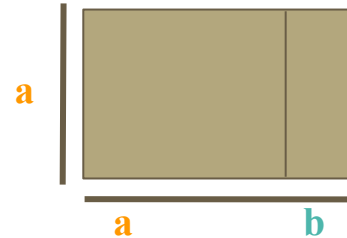
The ***Fibonacci sequence*** is a series of numbers where a number is the addition of the last two numbers, starting with 0, and 1.

If you were to draw squares with the proportions of the numbers in the sequence you would create the famous ***Golden Ratio Rectangle*** as shown on the right.



Example problem:

Question: If you have a piece of wood that is 0.75 meters wide, how long should you cut it such that the ***Golden Ratio*** is observed?



Answer:

$$W = 0.75 \quad 1.618 = \frac{L}{0.75m}$$

$$L = 1.618 * 0.75m = 1.2135m$$

In conclusion the length of the piece of wood is 1.2135m and the width is 0.75m.